



**UNIVERSITI PUTRA MALAYSIA**

**CLINICO-EPIDEMIOLOGIC STUDY OF ACUTE RESPIRATORY  
TRACT INFECTIONS AMONG THE STUDENT COMMUNITY OF  
UNIVERSITI PUTRA MALAYSIA**

**DR. EZRA JAMAL (M.B.B.S)**

**FPSK (M) 2002 9**

**CLINICO-EPIDEMIOLOGIC STUDY OF ACUTE RESPIRATORY TRACT  
INFECTIONS AMONG THE STUDENT COMMUNITY OF UNIVERSITI  
PUTRA MALAYSIA**

**BY**

**Dr. EZRA JAMAL (M.B.B.S)**

**Thesis Submitted in the Fulfilment of the Requirement for the Degree of  
Master of Science in the Graduate School  
Universiti Putra Malaysia**

**January 2002**



TO  
my parents  
And  
my beloved children  
Shah Mohammed Ali and Maryam Maqbool  
for their love, affection  
and encouragement  
that elevated my spirits.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

**CLINICO-EPIDEMIOLOGIC STUDY OF ACUTE RESPIRATORY TRACT  
INFECTIONS AMONG THE STUDENT COMMUNITY OF UNIVERSITI  
PUTRA MALAYSIA**

**By**

**Dr. EZRA JAMAL (M.B.B.S)**

January 2002

**Chairman: Prof. Datin Dr. Farida Jamal**

**Faculty: Medicine and Health Science**

Acute respiratory tract infections (ARI) are commonly encountered. Although usually self-limiting in young and working adults, their economic burden is enormous. Currently, published data on epidemiology of ARI among Malaysian adults is lacking particularly in general practice setting. The present clinico-epidemiological study was carried out with this in view. The study of ARI among the Universiti Putra Malaysia (UPM) student community was carried out for a period of one year (1998), following the guidelines set by WHO. Students attending the Student Health Center (SHC) of UPM with the complaints of ARI between the ages 17-40 years were included. An illness was considered to be an ARI if at least three of the following complaints were present: running or blocked nose, phlegm (post nasal drip), sore throat or difficulty in swallowing, fever or body pain, ear pain or discharge, hoarseness of voice, headache and cough of less than one week duration with or without sputum and with or without difficulty in breathing. A cross sectional study design using prospective data of ARI subjects was carried out. Information from general physical and clinical examination, management and

follow-up, etc. was recorded. Responses of the patients to a standard questionnaire were also recorded for each episode of ARI.

The total number of ARI cases seen at the SHC, UPM was 22444 in 1997, 22317 in 1998 and 24893 in 1999. For the year of the study (1998), 22317 episodes of ARI were observed among 2250 students. The ARI burden was 50.91%, with 6 episodes per student. Among the cases, 51% were males and 49% females; the mean age was 22 year. ARI incidence was 69.74%. A random sample of 150 ARI subjects was used for a detailed study. The data collected were analysed using SPSS version 10.01. Among 150 the subjects, 56% were males and 44% females, the mean age was 22 years. Sinusitis was the commonest condition, (28%). This was followed by rhinitis (22.7%), tonsillitis (12.7%), asthma (12%), pharyngitis (10.7%), ARI cases involving the ear (6.7%), vasomotor-rhinitis (6%), pneumonia (0.66%) and laryngitis (0.66%). Tonsillitis was more common among the females; asthma and sinusitis were more common among the males. Antibiotics were used for 89.3% of the ARI episodes. About 56.7% of the cases were acute and managed with erythromycin. Augmentin was given to the 32.7% chronic cases. Milder cases (10.7%) were managed symptomatically without any antibiotic therapy. When the patients' first episode was considered antibiotic was used in 66% of the cases. The 37% acute cases were managed with erythromycin, the 34% milder cases were managed symptomatically, and the 28.7% chronic cases were given augmentin. Self-medication was practiced by 45.3% of the subjects. About 68.7% of the 150 patients had one or more type of allergy, while 31.3% were non-allergic individuals. Of the 150 subjects active smokers were 34.7%, passive smokers 28.7% and non-smokers 36.7%; all the females claimed to be non-smokers.

A residual effect of the disease was seen in 12.7% of the cases, with sore throat off and on (though clinically the throat looked normal), and nasal mucosa itching. Forty eight percent had cough off and on, with sore throat and nasal mucosa itching. Six percent of the cases were referred to University Hospital Kuala Lumpur for further management and follow up. Impact of ARI on the life-style of the 150 students was also evaluated. All agreed that ARI not only affected their physical and social well being, but also reduced concentration in their studies and productivity and increased absenteeism from classes (54% had three days sick leave).

This research on students with ARI serves as a microcosm for sufferers from ARI. Data obtained may be used to develop ways to diagnose and manage ARI in general practice setting elsewhere.

Abstrak tesis yang disampaikan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk mendapat Ijazah Master Sains.

**KAJIAN 'CLINICO-EPIDEMIOLOGY ACUTE RESPIRATORY TRACT INFECTIONS' DI KALANGAN KOMUNITI PELAJAR UNIVERSITI PUTRA MALAYSIA**

**Oleh**

**Dr. EZRA JAMAL (M.B.B.S)**

Januari 2002

**Pengerusi: Prof. Datin Dr. Farida Jamal**

**Fakulti: Perubatan dan Sains Kesihatan**

Infeksi saluran pernafasan akut (ARI) adalah satu jangkitan yang sering ditemui. Walaupun infeksi ini biasanya bukan teruk di kalangan dewasa muda, beban ekonominya adalah sangat berat. Kini, data tercatat mengenai epidemiologi ARI di kalangan orang dewasa di Malaysia masih kurang dalam situasi pengamalan perubatan am (general practice setting). Kajian 'clinico- epidemiological' ini dijalankan dengan mengambil kira keadaan tersebut. Kajian ARI di kalangan pelajar Universiti Putra Malaysia (UPM) telah dijalankan selama satu tahun (1998), mengikut garis panduan yang ditetapkan oleh WHO. Pelajar yang hadir di Pusat Kesihatan Pelajar (PKP) UPM dengan masalah ARI dalam lingkungan umur 17-40 tahun disertakan dalam kajian ini. Sesuatu penyakit diambilkira sebagai ARI jika sekurang-kurangnya satu daripada tiga masalah yang berikut didapati: Selsema atau hidung tersekat, 'phlegm' (lelehan lepas nasal), sakit kerongkong atau kesukaran menelan, demam atau sakit badan, sakit telinga atau discaj daripada telinga, keparauan suara, sakit kepala dan batuk yang kurang daripada satu minggu dengan atau tanpa 'sputum', dan dengan atau tanpa masalah bernafas. Keadah yang

digunakan adalah rekabentuk kajian hirisan lintang menggunakan data prospektif subjek ARI (A cross sectional study design using prospective data of ARI subjects) Maklumat yang merangkumi pemeriksaan umum fizikal dan klinikal, pengurusan dan 'follow up', dan sebagainya telah disediakan dan direkod Respons pesakit terhadap borang soal-selidik bagi setiap episod ARI mengikut protokol juga direkodkan

Jumlah kes ARI yang telah dipemeriksa dan diberi rawatan di PKP, UPM pada tahun 1997 adalah 22444, pada 1998 adalah 22317 dan pada 1999 adalah 24893 Pada tahun kajian (1998), 22371 episod, ARI didapati di antara 2250 pelajar Beban ARI adalah 50.91% dengan 6 episod setiap pelajar Antara kes ini 51% adalah lelaki dan 49% wanita, umur min adalah 22 tahun Sampel rawak seramai 150 subjek ARI dipilih untuk kajian yang terperinci Data yang diperolehi telah dianalisis dengan menggunakan SPSS versi 10.01 Daripada 150 subjek tersebut, 56% adalah lelaki dan 44% wanita, dan min umur adalah 22 tahun Diagnosis yang lazim adalah 'sinusitis', (28%) Ini diikuti oleh 'rhinitis' (22.7%), 'tonsillitis' (12.7%) 'asthma' (12%), 'pharyngitis' (10.7%), ARI yang melibatkan telinga (6.7%), 'vasomotor-rhinitis' (6%), 'pneumonia' (0.66%), dan 'laryngitis' (0.66%) 'Tonsillitis' adalah lebih sering ditemui di kalangan wanita manakala 'asthma' dan 'sinusitis' adalah lebih di kalangan lelaki Antibiotik digunakan pada 89.3% episod ARI Lebih kurang 56.7% kes adalah akut dan diurus dengan erythromycin Augmentin diberi kepada 32.7% kes kronik Kes ringan (10.7%) diurus berdasarkan simptom tanpa sebarang terapi antibiotik Apabila episod pertama pesakit dipertimbangkan, penggunaan antibiotik adalah pada 66% kes Sebanyak 37% yang akut diurus dengan erythromycin, 34% kes ringan diurus berdasarkan simptom dan 28.7% kes



kronik telah diberi augmentin. Terdapat 45.3% daripada subjek mengamalkan rawatan sendiri. Lebih kurang 68.7% daripada 150 pesakit tersebut mempunyai satu atau lebih alahan, manakala 31.3% merupakan individu tanpa alahan. Antara yang 150, perokok aktif merupakan 34.7%, bukan perokok 36.7% dan perokok pasif 28.7%; dan semua wanita melaporkan diri sebagai bukan perokok.

Kesan residual diperhatikan pada 12.7% kes, dengan sakit tekak sekali-sekala (walaupun pemeriksaan klinikal menunjukkan tekak yang normal) dan kegatalan 'nasal mucosa'. Empat puluh lapan peratus terdapat batuk sekali-sekala, dengan sakit tekak dan kegatalan 'nasal-mucosa'. Enam peratus kes telah dirujuk kepada Hospital Universiti Kuala Lumpur untuk pengurusan dan tindakan yang selanjutnya. Kesan ARI terhadap cara hidup 150 orang pelajar yang berkenaan juga dinilai. Kesemuanya bersetuju bahawa ARI bukan sahaja mempengaruhi kesihatan fizikal dan sosial mereka, tetapi juga mengurangkan konsentrasi pada pelajaran, dan produktiviti dan meningkatkan ketidakhadiran kelas.

Kajian ini ke atas pelajar dengan ARI merupakan satu 'microcosm' bagi pesakit ARI. Hasil kajian ini juga boleh digunakan untuk membentuk cara diagnosis dan pengurusan ARI di kalangan pengamal perubatan umum di tempat lain.

## ACKNOWLEDGMENTS

In the name of Allah most gracious, the most merciful. Praise is to Allah, the cherisher and sustainer of the worlds. Show us the straight way, and O my Lord! advance me in knowledge.

My deepest gratitude and appreciation to my supervisor Prof. Datin Dr. Farida Jamal for her advice and guidance, and to my co-supervisor Dr. Jothi Malar Panandam for her dynamic help and encouragement with golden ameliorative advice throughout the statistical analysis of the data and to Prof. Dr. Zaitun Yassin for her encouragement, support and her cognitive religious advice throughout this project.

Special thanks to Dr Haji Yahaya Abu Ahamed, Head of the Student Health Center, colleague doctors and all the staff members for their tremendous help and co-operation, and also to all my friends, especially to Prof. Dr Margaret. C. McLaren and Prof. Dr Ian Andrew McLaren for their kindness and advice in successfully completing the project.

Lastly, I would like to thank my son Shah Mohammad Ali and daughter Maryam Maqbool for their endurance, inspiration and their accompaniment throughout the research and preparation of this document.


I certify that an Examination Committee met on 7<sup>th</sup> January 2002 to conduct the final examination of Ezra Jamal on her Master of Science thesis entitled "Clinico-Epidemiological Study of Acute Respiratory Tract Infections among the Student Community of Universiti Putra Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

Lekhraj Rampal, Ph.D.  
Associate Professor,  
Faculty of Medicine and Health Sciences,  
Universiti Putra Malaysia.  
(Chairman)

Datin Faridah Jamal, Ph.D.  
Professor,  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia,  
(Member)

Jothi M. Panandam, Ph.D.  
Associate Professor,  
Faculty of Agriculture,  
Universiti Putra Malaysia.  
(Member)

Zaitun Yassin, Ph.D.  
Associate Professor,  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia,  
(Member)

  
**AINI IDERIS, Ph.D.**  
Professor,  
Dean of Graduate School,  
Universiti Putra Malaysia

Date: 7 FEB 2002

This Thesis was submitted to the Senate of Universiti Putra Malaysia and was accepted as fulfillment of the requirements for the degree of Master of Science.



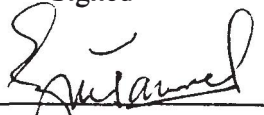
---

AINI IDERIS, Ph.D.  
Professor Dean of Graduate School,  
Universiti Putra Malaysia.

Date: 14 MAR 2002

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

Signed

  
\_\_\_\_\_  
Ezra Jamal  
Date:

## TABLE OF CONTENTS

	Page
<b>DEDICATION</b>	<b>ii</b>
<b>ABSTRACT</b>	<b>iii</b>
<b>ABSTRAK</b>	<b>vi</b>
<b>ACKNOWLEDGEMENTS</b>	<b>ix</b>
<b>APPROVAL SHEET</b>	<b>x</b>
<b>DECLARATION FORM</b>	<b>xii</b>
<b>LIST OF TABLES</b>	<b>xv</b>
<b>LIST OF FIGURES</b>	<b>xvi</b>
<b>LIST OF ABBREVIATIONS</b>	<b>xvii</b>
 <b>CHAPTER</b>	
<b>1 INTRODUCTION</b>	<b>1</b>
1.1. General Objective	2
1.2. Specific Objectives	2
1.3. Significance of the Study	3
 <b>11 LITERATURE REVIEW</b>	<b>5</b>
2.1. Definition of ARI	5
2.2. Anatomy and Functions of Respiratory Tract	8
2.3. Nose and Naso-Pharynx	8
2.4. Sinuses	9
2.5. Incidence and Prevalence of ARI	9
2.6. World Health Organization Report on ARI	11
2.7. ARI Morbidity and Mortality in Malaysia	12
2.8. Health Care Service and their Economic Impact	15
2.9. Diagnosis and Management Care	17
2.10. Rhinitis	19
2.11. Sinusitis	20
2.12. Pharyngitis	22
2.13. Bronchitis	24
2.14. Asthma	25
2.15. Etiological Agents	26
2.16. Factors Related to ARI	27
2.17. Complications of ARI	30
2.18. Self Medication with Respect to ARI	31
 <b>111 MATERIALS AND METHODS</b>	<b>33</b>
3.1. Study Location	33



3.2.	Study Design	34
3.3.	Study Population	34
3.4.	Sample Size	34
3.5.	Sample Selection	35
3.6.	Inclusion Criteria	35
3.7.	Exclusion Criteria	35
3.8.	Study Procedure	36
3.9.	Data Collection	38
3.10.	Definition of Terms	40
3.11.	Data Analysis	41
3.12.	Limitation of the Study	41
1V	RESULTS	43
4.1.	Incidence of ARI Cases	43
4.2.	Socio-demographic Characteristic of the Respondents	46
4.3.	Description of ARI Cases and their Management, Duration and Complications	48
4.4.	Self-medication with Respect to ARI	61
4.5.	Association of Allergy with ARI	65
4.6.	Association of ARI with Smoking	68
V	DISCUSSION	71
V1	CONCLUSION AND RECOMMENDATIONS	86
6.1.	Conclusion	86
6.2	Recommendation	87
	BIBLIOGRAPHY	89
	APPENDICES	103
	VITA	136

## LIST OF TABLES

### Tables

<b>2.1.</b>	<b>Morbidity and Mortality Cases in Malaysia 1995-1998</b>	<b>14</b>
<b>4.1.</b>	<b>Socio-Demographic Characteristics of the Subjects in the Study</b>	<b>47</b>
<b>4.2.</b>	<b>Most Common ARI Complaints among the 150 Students</b>	<b>48</b>
<b>4.3.</b>	<b>Common Signs and Symptoms of Sinusitis</b>	<b>50</b>
<b>4.4.</b>	<b>Common Signs and Symptoms of Rhinitis</b>	<b>51</b>
<b>4.5.</b>	<b>Common Signs and Symptoms of Asthma</b>	<b>52</b>
<b>4.6.</b>	<b>Distribution of Provisional Diagnosis with respect to ARI Episodes</b>	<b>54</b>
<b>4.7.</b>	<b>Association of Gender with Provisional Diagnosis of ARI</b>	<b>55</b>
<b>4.8.</b>	<b>Distribution of Sick Leave Days for the Year due to ARI by Gender</b>	<b>56</b>
<b>4.9.</b>	<b>Distribution of Provisional Diagnosis of ARI by Management</b>	<b>57</b>
<b>4.10.</b>	<b>Association of Residual Effect with ARI Episode</b>	<b>69</b>
<b>4.11.</b>	<b>Self-medication with respect to ARI</b>	<b>61</b>
<b>4.12.</b>	<b>Self-medication with respect to ARI by Gender</b>	<b>62</b>
<b>4.13.</b>	<b>Association of Management with Self-medication</b>	<b>63</b>
<b>4.14.</b>	<b>Types of Residual Effect of ARI by Self-medication with respect to ARI</b>	<b>64</b>
<b>4.15.</b>	<b>Association of Allergy with Gender of Respondents</b>	<b>65</b>
<b>4.16.</b>	<b>Distribution of Allergic Complaints with Provisional Diagnosis of ARI</b>	<b>67</b>
<b>4.17.</b>	<b>Association of Provisional Diagnosis of ARI and Smoking Status</b>	<b>69</b>
<b>4.18.</b>	<b>Association of Smoking Status with Residual Effect of ARI</b>	<b>70</b>



## LIST OF FIGURES

### Figures

2.1.	Respiratory System	6
2.2	Common Causes of Sore Throat, Cough, and Allergic Rhinitis	23
3.1	Procedure of Assessment of Student at SHC	37
4.1	Distribution of ARI Cases by Years in 1997-99 at SHC	43
4.2	Distribution of ARI Cases by Months in 1998	44
4.3	Distribution of ARI Cases by Race in 1998	45
4.4.	Distribution of ARI Cases by Gender in 1998	46
4.5.	Frequency of ARI Cases According to Provisional Diagnosis	49
4.6.	Frequency of ARI Cases according to Condition of Patients	58
4.7.	Residual Effect of ARI among the Subjects	60

## CHAPTER I

### INTRODUCTION

ARI are a major cause of morbidity and mortality throughout the world, accounting for as many as 2.2 million deaths annually (WHO, 1987; 1982). ARI imposes a burden on the health care system and socioeconomic status (Bulter, 1998). Nasal congestion, stuffiness, or obstruction to nasal breathing is one of man's oldest and most common complaints. It is a source of considerable discomfort and detracts from the quality of life and reduces the ability to attain peak performance (Katelaris *et al.*, 2000; Nightingale, 1996). Laryngitis (hoarseness of voice) is a simple disorder but may also signify the presence of serious illness such as malignancy or airway compromise. A voice problem affects a person socially and at work place and may cause tremendous alterations in daily life (Garrette & Ossoff, 1999).

The commonest infections managed by general practitioners in the community are those of respiratory system (acute sore throat, acute cough or bronchitis, acute sinusitis, acute red ear or otitis-media etc.) (Little & Williamson, 1996; Pio *et al.*, 1985). Acute respiratory infections (ARI) may be attributed to an interaction between the host, the infectious agent and the environment. The majority of ARI are mild and self-limiting. However, if an individuals' defence mechanism is not strong enough, the disease may become complicated or leave sequelae. Recurrent infection of the respiratory tract may lead to chronic airway disease and acute respiratory distress syndrome later (WHO, 1984; Lesuar *et al.*, 1999). ARI progressively damages the defence immune mechanism and the human body becomes vulnerable to other infections (Brandtzaet *et al.*,

1997). General practitioners, Budak *et al.* (1998) reported a 71.9 % of ARI morbidity rate in their out-patient health care. High prevalence of ARI among all age groups and both sexes have also been reported in Malaysia by Ministry of Health Malaysia (personal communication).

ARI among children has been extensively studied by Deb (1999), Wafula *et al.* (1990), Vuesquez *et al.* (1999) and Enarson & Chretien, (1999) because of increase in morbidity and mortality (WHO, 1991). Available epidemiological data on adults is very scanty. This lacking of community-based data on ARI in many developing countries was recognized by WHO (1984). Moreover, despite the common occurrence of ARI globally, most of the supportive data available are from the temperate areas. Data from the tropics and subtopic are very scanty (Smith *et al.*, 1999), especially in general practice setting. Thus, the present cross-sectional study using prospective data was carried out with the above in view.

### **1.1. General Objective**

The general objective of this study was to determine the clinico-epidemiologic pattern of acute respiratory tract infections (ARI) among the student community attending the Student Health Centre in Universiti Putra Malaysia.

## **1.2. Specific Objectives**

The specific objectives of this study were:

1. To assess the workload of ARI on the Student Health Centre in UPM and to determine its incidence.
2. To describe the distributions of ARI according to the socio-demographic characteristics of the respondents.
3. To describe ARI and their management, duration, and complications.
4. To assess the practice of self-medication in relation to ARI, among the respondents.
5. To describe the association of ARI with respect to allergy.
6. To describe the association of ARI with respect to smoking.

## **1.3. Significance of the Study**

A clinico-epidemiologic study on ARI among the university students is of major significance both to the university and to the wider community. ARI is very common among the student community. Repeated ARI may affect a student's health and education. Most ARI are not notifiable and majority of these cases are seen in the outpatient department (OPD) and in general practice setting (GP) where the atmosphere is not conducive to research, work load and laboratory facilities are limited or not available due to high cost and lack of transport. Moreover, ARI is mostly presented in acute form requiring urgent diagnosis and immediate management care.

Therefore the present study was carried out to generate some information on ARI prevalence in a community of adults in a tropical country.

The data generated from this study would provide a picture of the seriousness of ARI in student community. It may be used as the basis to develop appropriate management care and preventive procedures.

## CHAPTER II

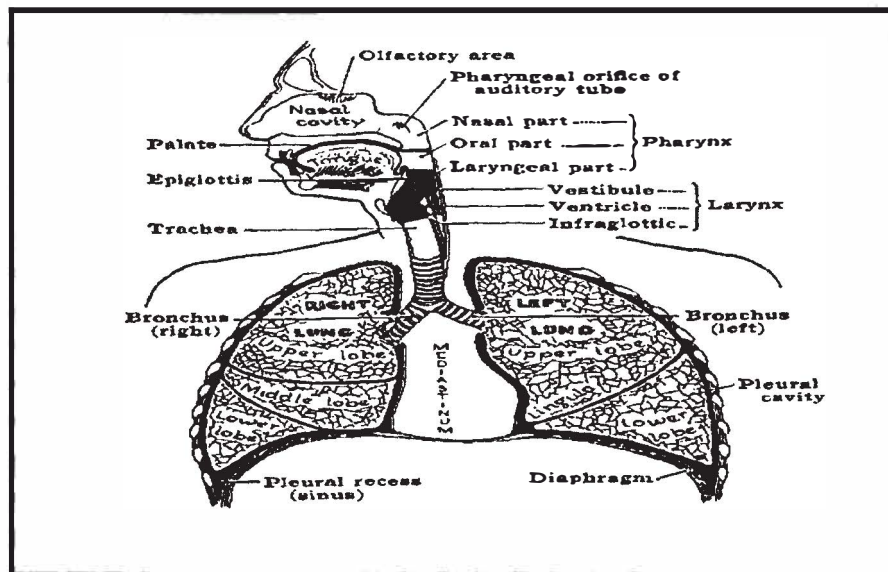
### LITERATURE REVIEW

The etiological agents of acute respiratory tract infections (ARI) include viruses, bacteria, and fungi (Torzillo *et al.*, 1999). Environmental, genetic and social factors are important associated factors (Szczeklik, 1999; Moffatt *et al.*, 1999; Bodner *et al.*, 1997). Nutritional status of the people involved also plays a major role (Wilson *et al.*, 1996). If the body's defence mechanism is strong enough to nullify the effects of these external causative agents, the disease can become self-limiting without leaving any sequelae. The level of immune function is the key determinant in the appearance of disease and respiratory infections are frequently associated with immunodeficiency (example, *Pneumocystis carinii* pneumonia in HIV cases). Characteristics of the pathogen, including virulence and bacterial load, also determine the probability and severity of respiratory infections. Modifiers of these determinants include allergy, toxic exposure, including tobacco smoke and ambient pollution.

#### 2.1. Definition of ARI

The respiratory tract may be divided into two parts; the upper respiratory tract is the region above the vocal cord, and the lower respiratory tract is the one below (Figure 2.1). Infections of these may be referred to as upper and lower respiratory tract infections. The upper respiratory tract is continuously exposed to viral, bacterial, fungal and environmental irritants (Zemp *et al.*, 1999). Respiratory

tract infections can present as various clinical conditions, ranging from mild to severe. These include common cold, rhinitis, sinusitis, rhino-pharyngitis, pharyngitis, tonsillo-pharyngitis, tonsillitis, laryngitis, trachitis, bronchitis, broncheolitis, pneumonia and bronchopneumonia.



**Figure 2.1. The Respiratory system (Boileau-Grant , 1972, p. 412)**

Since 1963, the World Health Organization has been concerned with the difficulty of estimating the actual importance of ARI within the communicable diseases group (1978). In 1982 the World Health Organization approved the Seventh General Programme of Work 1984-89 in which ARI control appeared as one of the seventeen programmes in the section of disease prevention and control. Research conducted through WHO on ARI has proved that it is multifactorial and complex in nature and hence it is referred to as a syndrome. Its public health importance is now

well established. ARI is recognized as the leading cause of morbidity and mortality, especially in the developing countries, affecting both sexes and all age groups (Smith *et al.*, 1999). However, little published data are available about the etiology, pathogenesis, and predisposing factors of acute respiratory tract infection (ARI) and the value of the various methods used for their diagnosis and treatment, particularly in the developing countries (WHO, 1984) and among adult patients.

Recent advances in the field of immunology have opened other challenges for ARI. The old concept of "we are what we eat" was changed to "we are what we breathe". This concept is now the focus of attraction of many researchers. Robert, (1997) carried out epidemiological studies and laboratory-based investigations of asthmatic and rhinitic individuals, exposed to ozone (O<sub>3</sub>), NO<sub>2</sub>, and combination of NO<sub>2</sub> and SO<sub>3</sub>. The results indicated that these agents might increase the airway responsiveness of individuals to inhaled allergens and infectious agents (Robert,1997). Pollution from the industry and heavy dust particles from earth works produce smog and result in difficulty in breathing and hence increase the incidence of ARI. (WHO,1984). Currently, environmental pollution resulting from rapid modernization in many developing countries is a major problem (Yang *et al.*, 1999). This plays a role in the occurrence of epidemics of ARI, with hypersensitivity as an important predisposing factor (Thomas *et al.*,1998).



## **2.2. Anatomy and Functions of Respiratory Tract**

The main function of the respiratory system is to provide for the intake of oxygen and to eliminate carbon dioxide. Respiratory tissue, where the gaseous exchanges occur, is located in the lungs, which lie within the thoracic cavity. Lungs are connected to the exterior by a series of passages: nose, pharynx, larynx, trachea and the bronchi (Figure 2.1). These passages are relatively rigid in structure and are constantly open; together they comprise the conducting portion of the respiratory system. The main functions of these parts are that they strain out particulate matter, wash and humidify, and either warm or cool the inspired air depending upon the ambient temperature. The lungs and the conducting passage constitute the respiratory system.

## **2.3. Nose and Naso-pharynx**

The nose collects moisture from the expired air and prevents excessive loss of water from the respiratory tract. Stiff hairs in the nose filter the harmful particles from inhaled the air. The lining of the nose helps in the enzymatic destruction of viruses and bacteria. The epithelial cells that line the nasal mucosal surface act as a mechanical barrier that separates the host from the external environment. Nasal epithelium also serves as an affecter organ producing various mediators, which regulate the defense mechanism of the host. It is covered by cilia that move in a periciliary fluid layer (mucous layer), resulting in mucociliary pathway. Inhaled bacteria